NEWS SCIENCE NEWS

REGENERATION OF MAMMALIAN BODY PARTS

by Bengt Larsson, MSc © 2006

A patented gel extracted from immunologically immature chickens has been shown to regrow limbs of pets as well as successfully treat burns and bedsores.

Miracle mice

When, in 1994, Dr Ellen Heber-Katz of the Wistar Institute in Philadelphia was monitoring marked mice in a group that she used as experimental animals in connection with her research on multiple sclerosis, she received a surprise. The marked mice could not be found! They had punch holes in the ears for identification, and at first it seemed as though a mistake had been made, for now all of the mice had ears without any holes in them. The experiment was repeated and it became clear that the holes were repairing themselves in about three weeks and leaving no scars. Initially, a number of immature cells formed along the edges of the hole to give a regeneration blastema which rapidly subdivided so that the hole gradually closed up. There was perfect re-formation of cartilage, blood vessels and skin.

In contrast to water lizards, for example, mammals have been considered to have very little ability to reconstruct parts of the body. The severed tail or leg of a newt can regrow completely. The cells just beneath the cut surface form undifferentiated mesenchyme cells—a blastema which grows further and forms precisely the differentiated cells that are distal from the cut.

With humans, it is known that the final joint of the fourth finger in a small child can regrow. This was discovered following an accidental failure to cover a cut surface with skin, which would have otherwise prevented the regrowth.

Luckily, Dr Heber-Katz's mice were unaware that what they had done was impossible according to established medical doctrine.

What was special about these mice? Well, part of their immune defence was missing: the alpha-beta T-cells. These so-called MRL mice had been bred for studies of auto-immune diseases such as lupus.

Further experiments carried out by Dr Heber-Katz and her group have shown that these mice can also regrow bone, muscles and the central nervous system. For example, a docked mouse regrew its tail, a severed visual nerve repaired itself, and mobility returned after about one month following partial removal of spinal marrow. In addition, the hearts of the MRL mice have the ability to recover after extensive damage.

In the area of stem cell research, methods are currently being intensively developed for the repair of tissues and organs in the human body. Stem cells have the ability to develop into types of specialised (differentiated) cells. Pluripotent stem cells can produce most types of cells, while multipotent stem cells can give only a limited number of different cell types. It is known that adults have stem cells in the skin, the liver, the brain, bone marrow and elsewhere, but they are present in only small amounts and are difficult to isolate. What is needed is a method to deprogram differentiated cells so that they become preferably pluripotent stem cells or at least multipotent stem cells, which then could be made to differentiate to the desired type of cell.

It is possible, however, that the problem of how to make human arms and legs regenerate themselves is nearly solved. The readers can learn about this in what follows.

Stem cell problem solved?

In 1964, the veterinarian Dr Harry Robertson happened to burn his hand and sought relief by quickly immersing it in a gel which was nearby. After 10 minutes, the pain had disappeared, there were no blisters, and in due course the hand healed without any scars. The gel was a fresh extract of chicken bones, used as a cheap source of protein. After testing its healing properties on animals and humans, Dr Robertson began to market it under the name Revital. Dr Robertson claimed that Revital is antibacterial and antiviral, can regenerate nerves and muscles, can heal third-degree burns without scar formation so that transplantation is unnecessary, and can eliminate acne scars and heal difficult bedsores.

Healing seriously injured pets

In one example, injuries in cats leading to the loss of 2.5 cm broad pieces of muscle were packed with Revital three times per day for a period of three weeks, leading to complete re-growth of the muscle.

A dog had been dragged beneath a car, losing most of its thigh muscle and leaving a large part of the thigh bone and hip joint exposed. As an alternative to having the dog put down, Dr Robertson applied Revital and bandaged the injury, whereupon the dog appeared to feel little or no pain within an hour. When the injury was rebandaged several days later, it was found to be completely clean and healing well, although it smelled strongly. The dog recovered completely and grew new hair.

Dr Robertson had been taught that when muscles and nerves are destroyed, they cannot regenerate themselves; but in numerous cases he found that regeneration did occur when Revital was used. On one occasion, a poodle that had chewed off its foot had the stump packed with Revital, which led to the growth of a new foot! Another dog suffered 40 per cent burns to its body and was healed completely with Revital.

Dr Robertson documented his claims by taking a series of photographs throughout the healing process.

Revital patent and registration

Several people have testified to the successful treatment of their burns, cuts, abrasions, herpes simplex blisters and bedsores with Revital.

The production of Revital is straightforward and is done by extracting ground-up chicken legs with vinegar. The whole procedure is described in US Patent No. 4,455,302 of June 1984. One kilogram

of chicken legs gives 50 grams of Revital.

In 1977, Dr Robertson began to sell products which he had made himself. He applied to the US Food and Drug Administration (FDA) for permission to market Revital as a "Class I device" (baby powder also belongs to this group) and this was allowed without prescription since it contained no physically damaging substances. The sales of Revital in the local pharmacy rose to US$39,000 per month from word-of-mouth advertising, and in addition there were postal sales.

The June 1981 issue of *Science Digest* published a four-page article about Dr Robertson. In the same year, the FDA asked Dr Robertson to register Revital as a drug—a process which could take up to 10 years and cost millions of dollars, but with the aid of lawyers he was able to retain the "Class I device" designation.

Subsequently, the FDA reported that Revital contained high levels of bacteria and did not comply with its requirements. Dr Robertson was therefore forbidden to market his products.

FDA stops Dr Robertson and Revital

Like SS stormtroopers, FDA agents raided the John L. Deaton Medical Center in Baltimore and confiscated all Revital products in the ward where patients with chronic bedsores were being treated. The FDA was required by the Freedom of Information Act to produce the results of its sterility tests on the three random samples they had examined, but was unable to provide any evidence of contamination.

At Dr Robertson's request, several random samples of Revital were sent to four different independent laboratories, and all reported that the product satisfied sterility requirements of the United States Pharmacopeia (UPS). (Note: preparations of Revital have a typical pH of ~4.6, which, to say the least, is not ideal for the growth of bacteria!)

However, the FDA was determined to prevent the sale of Revital in the "country of free enterprise", and Dr Robertson was warned not to attempt to reintroduce his product. He was now nearly 80 years old and too disheartened to try to market Revital in another country.

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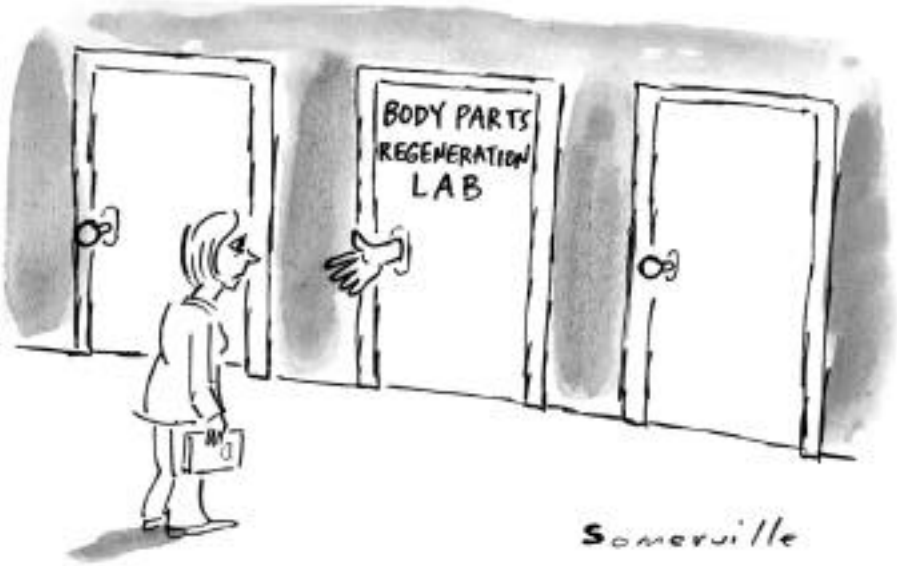
Thus did the FDA succeed in killing off this miracle remedy.

Relationship between experiments

What is the connection between Dr Robertson's Revital discovery and Dr Heber-Katz's experiments on mice? The answer is that the mice had an incomplete immune defence system. In order to achieve regeneration, the chicken leg extract must be from immunologically immature chickens, i.e., less than nine weeks old. How does chicken leg extract from immunologically immature chickens differ from that from immunologically mature chickens? Nobody knows, but it should be possible to find out. It is possible that a tissue extract from immunologically immature animals has the ability to transform human skin cells (which are easy to grow) to stem cells, solving the problem of how to produce large amounts of stem cells. ∞



Endnotes

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• The information on Dr Harry Robertson is taken from the article "Curative Protein of Chicken Feet", pp. 185-187, in the compendium Creative Alternatives for a Troubled World, © 1993 Melvin D. Saunders, Pyramid Research Center, Box 478, Odenton, Maryland 21113, USA.

• The transcript of Harry J. Robertson's US Patent No. 4,455,302, "Medical protein hydrolysate, process of making the same and processes of utilizing the protein hydrolysate to aid in healing traumatised areas", can be found at http://www.uspto.gov/.

About the Author:

Bengt Larsson, MSc, has always been interested in revolutionary discoveries and inventions and is looking forward to the day when complete regeneration of human body parts is accomplished. Presently he is working as a senior high-school teacher in Vaxjo, Sweden. He can be contacted by email at bengt_larsson@kungsmadskolan.se.

RELATIVITY DRIVE: THE END OF WINGS AND WHEELS?

by Justin Mullins © 2006

Roger Shawyer has developed an engine with no moving parts that he believes can replace rockets and make trains, planes and automobiles obsolete. He has built a working prototype to test his ideas, and as a respected spacecraft engineer he has persuaded the British government to fund his work. Now organisations from other parts of the world are beating a path to his tiny company.

The device that has sparked their interest is an engine that generates thrust purely from electromagnetic radiation—microwaves, to be precise—by exploiting the strange properties of relativity. It has no moving parts, and releases no exhaust or noxious emissions. Potentially, it could pack the punch of a rocket in a box the size of a suitcase. It could one day replace the engines on almost any spacecraft. More advanced versions might allow cars to lift from the ground and hover. It could even lead to aircraft that will not need wings!

Shawyer worked his way up through the aerospace industry, designing and building navigation and communications equipment for military and commercial satellites before becoming a senior aerospace engineer at Matra Marconi Space (later part of EADS Astrium) in Portsmouth, UK. He was also a consultant to the *Galileo* project, Europe's satellite navigation system, which engineers are now testing in orbit and for which he negotiated the use of the radio frequencies it needed.

While at Astrium, Shawyer proposed that the company develop his idea. "I was told in no uncertain terms to drop it," he says. "This came from the very top."

Shawyer's technology rests on an idea that goes back to the physicist James Clerk Maxwell, who in 1871 worked out that light should exert a force on any surface it hits, like the wind on a sail. This so-called radiation pressure is extremely weak.

In 2005, a group called The Planetary Society attempted to launch a solar sail called *Cosmos 1* into orbit. The sail had a surface area of about 600 square metres. Despite this large area, its developers calculated that sunlight striking it would produce a force of three millinewtons, barely enough to lift a feather on the surface of the Earth. Still, it would be enough to accelerate a craft in the weightlessness of space. Unfortunately, the sail was lost after launch. NASA is also interested in solar sails, but has never launched one. Perhaps that shouldn't be a surprise, as a few millinewtons isn't enough for serious work in space.

But what if you could amplify the effect? That's exactly the idea that Shawyer stumbled on in the 1970s while working for the British military technology company Sperry Gyroscope. Shawyer's expertise is in microwaves, and when he was asked to come up with a gyroscopic device for a guidance system he instead came up with the idea for an electromagnetic engine. He even unearthed a 1950s paper by Alex Cullen, an electrical engineer at University College, London, describing how electromagnetic energy might create a force. "It came to nothing at the time, but the idea stuck in my head," he says. It led him to a way of producing thrust.

It has no moving parts, and releases no exhaust or noxious emissions.

For years, Shawyer has explored ways to confine microwaves inside waveguides—hollow tubes that trap radiation and direct it along their length. Take a standard copper waveguide and close off both ends. Now create microwaves using a magnetron, a device found in every microwave oven. If you inject these microwaves into the cavity, the microwaves will bounce from one end of the cavity to the other. According to the principles outlined by Maxwell, this will produce a tiny force on the end walls. Now carefully match the size of the cavity to the wavelength of the microwaves and you create a chamber in which the microwaves resonate, allowing it to store large amounts of energy.

What's crucial here is the Q-value of the cavity—a measure of how well a vibrating system prevents its energy dissipating into heat, or how slowly the oscillations are damped down. If microwaves leak out of the cavity, the Q will be low. A cavity with a high Q-value can store large amounts of microwave energy with few losses, which means the radiation will exert relatively large forces on the ends of the cavity. Shawyer worked out that with a suitably shaped resonant cavity, wider at one end than the other, the radiation pressure exerted by the microwaves at the wide end would be higher than at the narrow one.

Key is the fact that the diameter of a tubular cavity alters the path—and hence the effective velocity—of the microwaves travelling through it. Microwaves moving along a relatively wide tube follow a more or less uninterrupted path from end to end, while microwaves in a narrow tube move along it by reflecting off the walls. The narrower the tube gets, the more the microwaves get reflected and the slower their effective velocity along the tube becomes. Shawyer calculates that the microwaves striking the end wall at the narrow end of his cavity will transfer less momentum to the cavity than those striking the wider end. The result is a net force that pushes the cavity in one direction.

Since the microwave photons in the waveguide are travelling close to the speed of light, any attempt to resolve the forces they generate must take into account Einstein's special theory of relativity, i.e., that microwaves move in their own frame of reference. In other words, they move independently of the cavity, as if they are outside it. As a result, the microwaves themselves exert a push on the cavity.

Armed with his prototypes, the test measurements and the positive review by UK government–hired independent space engineer John Spiller, Shawyer is now presenting his design to the space industry. The reaction in China and the US has been markedly more enthusiastic than in Europe. "The European Space Agency knows about it but has not shown any interest," he says. The US Air Force has already paid him a visit, and a Chinese company has attempted to buy the intellectual property rights associated with the thruster.

Shawyer's plan is to license the technology to a major player in the space industry who can adapt the design and send up a test satellite to prove that it works. If all goes to plan, Shawyer believes he could see the engine tested in space within two years. He estimates that his thruster could save the space industry US$15 billion over the next 10 years. ∞

(Source: Edited from New Scientist, *issue 2568, 8 September 2006, pp. 30-34; Shawyer's theory paper is available at http://www.newscientist.com/data/images/ns/av/shawyertheory.pdf)*